PUNJAB PUBLIC SERVICE COMMISSION

COMBINED COMPETITIVE EXAMINATION
FOR RECRUITMENT TO THE POSTS OF
PROVINCIAL MANAGEMENT SERVICE, ETC -2021
CASE NO. 3C2022

SUBJECT: PRINCIPLE OF ENGINEERING (PAPER-I)

TIME ALLOWED: THREE HOURS   **MAXIMUM MARKS: 100**

NOTE:
- I. All the parts (if any) of each Question must be attempted at one place instead of at different places.
- ii. Write Q. No. in the Answer Book in accordance with Q. No. in the Q. Paper.
- iii. No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
- iv. Extra attempt of any question or any part of the question will not be considered.

NOTE: Attempt any FIVE questions in all, calculator is allowed (not Programmable) Draw clear diagrams where are necessary

Q No. 1 a) Explain in detail the Pauli Exclusion Principle. What do you understand by the term Zero-Point Energy, how do you relate it with uncertainty principle?

b) Discuss in detail free electron model, what are the main assumptions which are considered. Explain electron hole with help of suitable diagram.

(10+10=20 Marks)

Q No. 2 a) What does Galvanic Cell mean? Explain buffer solution in chemistry with examples.

b) Explain refractive index. how is it measured? Also discuss its applications. What is photoelectric effect? How X-Rays are produced? **(10+10=20 Marks)**

Q No. 3 a) For engineering applications which operating system is best for computers? What are security and privacy issues are rising due to internet and smart phones.

b) Explain the working of Class A and Class B amplifiers. write note on following modulations.
- i) AM
- ii) FM
- iii) PM
- iv) PWM

(10+10=20 Marks)

Q No. 4 a) What are the inherent problems of two stroke engines? Discuss the lubrication systems of two stroke engine. What Measures are usually taken to stop exhaust pollution and reduce the noise of two stroke engines?

b) Drawn the actual PV Diagram of 4 stroke petrol engine and explain it step by step.

c) Mr Aslam's car has a three-litter Spark Ignition V6 engine that operates on a four-stroke cycle at 3600 RPM. The compression ratio is 9.5, the length of connecting rods is 16.6 cm, and the engine is square (Bore = Stroke). At this speed, combustion ends at 20° ATDC. Calculate cylinder bore and stroke length of the engine. **(10+5+5=20 Marks)**

Q No. 5 a) Differentiate between traditional and engineering ceramics also explain the processing of engineering ceramics and their electric & mechanical properties.

b) What do you know about use of ceramics in weapons and explosives?

(15+5=20 Marks)

Q No. 6 a) How a cite for construction of a dam is selected? Write a note on the disadvantages of water dams for producing electricity.

b) A small inspection car with a mass of 200 kg runs along the fixed overhead cable and is controlled by the attached cable at A. Determine the acceleration of the car when the control cable is horizontal and under a tension T 2.4 kN. Also find the total force P exerted by the supporting cable on the wheels.
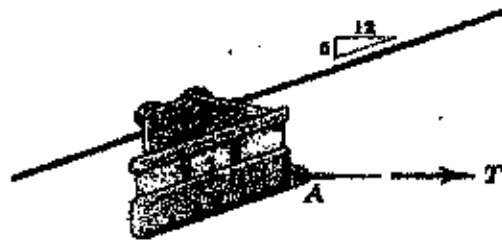
(10+10=20 Marks)

Q No. 7 a) Passengers in the jet transport A flying east at a speed of 800 km/h observe a second jet plane B that passes under the transport in horizontal flight. Although the nose of B is pointed in the 45° northeast direction, plane B appears to the passengers in A to be moving away from the transport at the 60° angle as shown. Determine the true velocity of B.

b) Write a detail note on how low-cost roads are prepared in developing countries.

(15+5=20 Marks)

Q No. 8 Write note on following properties of the materials.

i) Ultimate Tensile Strength.
ii) Toughness.
iii) Resilience.
iv) Ductility.
v) Malleability.

(5x4=20 Marks)

PUNJAB PUBLIC SERVICE COMMISSION

COMBINED COMPETITIVE EXAMINATION
FOR RECRUITMENT TO THE POSTS OF
PROVINCIAL MANAGEMENT SERVICE, ETC-2021
CASE NO. 5C-2022

SUBJECT: PRINCIPLE OF ENGINEERING (PAPER-II)

TIME ALLOWED: THREE HOURS   MAXIMUM MARKS: 100

NOTE:
I. All the parts (if any) of each Question must be attempted at one place instead of at different places.
II. Write Q. No. in the Answer Book in accordance with Q. No. in the Q. Paper.
III. No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
IV. Extra attempt of any question or any part of the question will not be considered.

Note: Attempt any five questions in all, including question No. 8 which is compulsory. Calculator is allowed. (Not Programmable). Standard statistical table of area under the normal distribution is provided.

Question 1

(a) In the context of decision analysis, differentiate between "decision making under uncertainty" and "decision making under risk". Also explain the "payoff table" and its limitation which makes way for using sequential decision trees.

(b) A person is planning to sue the manufacturer of a home improvement product which he believes caused damage to his property. He is planning to sue the company for $3.5 million. The company has offered him a settlement of $650,000, of which the complainant would receive $595,000 after processing fees. His attorney has advised him that there is 50% chance of winning his case. If he loses he will have to bear the court and other legal fees amounting to $75,000. If he wins even then the full requested settlement is not guaranteed. In the case of winning there is 50% chance that he will get full settlement in which case he would get $2.0 million after deduction of attorney fees, there also exists 50% chance that he may get a lesser amount of $1,000,000 of which he would ultimately get $500,000 after all the cuts. Using decision tree analysis, decide if complainant should sue the organization or settle the matter.   (10+10=20 Marks)

Question 2

(a) In the context of project management, discuss different types of logical dependancies that may exist within precedence relationships of the activities. Give examples while providing your answer.

(b) Following is the data for a project. Construct the network diagram, identify the critical path and determine the project duration

Activity	Activity Predecessor	Activity Duration (Weeks)
A	-	2
B	A	6
C	A	4
D	A	2
E	B	4
F	B,C,D	5
G	B	3
H	E,F	2

(8+12=20 Marks)

Question 3

Write a comprehensive note on quality-cost relationship while discussing the costs of poor quality, their categorizations and some common index measures for reportage of quality costs. Conclude your answer by drawing relevance of the discussed entities with profitability and competitiveness of an Organization.

(20 Marks)

Question 4

What do you understand by e-manufacturing? Provide a detailed overview of the various components and their roles in helping to enable it. **(20 Marks)**

Question 5

(a) In the context of inventory management, explain the total inventory cost function as it applies to quantity discount scenarios, for determining order quantities. Also elaborate as to why the optimal point as determined by basic saw tooth model may not be directly applicable for determining the order size as different quantity discount schedules are compared for feasibility. Use graphical illustration to explain your answer

(b) The daily demand of an electronic chip is uniformly distributed, with a mean of 26 units and standard deviation of 10 units. The lead time of receiving an order of chips from the electronic chip distributor is 9 days. The manager is interested in maintaining a 75% service level. What reorder point should be used by the manager to meet this service level? Also determine if the service level is to be increased to 95%, what would be the corresponding increase in the ROP. **(10+10=20 Marks)**

Question 6

(a) What is meant by "participatory approach" while managing the organizational tasks? Do you think that "Quality Circles" qualify as being a participatory approach? Provide arguments for your stance.

(b) The following set of seven jobs is to be processed through two work centers at a printing company. The sequence is first printing and then binding. Processing time at each work centers is shown in the following table:

Job	Printing (Hours)	Binding (Hours)
T	15	3
U	7	9
V	4	10
W	7	6
X	10	9
Y	4	5
Z	7	8

(I) What is the optimal sequence for these jobs to be scheduled

(II) Chart these jobs through the two work centers

(III) What is the total length of time for this optimal solution.

(IV) What is the idle time in the binding shop, given the optimal solution.

(8+12=20 Marks)

Question 7

(a) Discuss what information is provided by "cost accounting" and the different purposes this information serves.

(b) A city is considering a particular public sector project of infrastructure development at a particular location which involves bridge construction and setting of the recreational facility. Both entities (bridge and recreational facility) constitute the completed project. The construction costs for the bridge are projected to be $600,000 and the additional maintenance costs for the bridge are estimated to be $120,000. The state of the art recreational facility will be constructed at a cost of $500,000. The annual operating and maintenance costs for the recreational facility are estimated at $40,000. The annual benefits from the project are estimated in terms of savings from shorter travel times of $180,000, $40,000 as convenience benefits for the residents of the city and also the recreational facility visitor fees and tourism related activities, considering a useful life of 20 years and an interest rate of 10%, use benefit cost ratio (B/C) method to determine if the project should be undertaken or not. Use Annual Worth (AW) approach throughout while solving. **(10+10=20 Marks)**

Question 8   Choose the best option: (Compulsory)   (20 Marks)

(i) A structured process that translated the voice of the customer into technical design requirements is known as _____

a Concurrent design   b Modular design

c Quality function deployment   d Reverse engineering

(ii) The term "hoshins" refers to

a Performance assessments that includes more than financial metrics

b Action plans generated from the policy deployment process

c The characteristics of a product or service that qualify it to be considered for purchase

d None of the above

(iii) The degree to which a firm produces the parts that go into the product is known as _____

a Vertical integration   b Batch production   c Mass customization   d Positioning

(iv) "Service Blueprint" refers to

a A visual method for comparing customer perceptions of different services

b A type of process flowchart that emphasizes customer interaction and certain service related terms such as failure points etc.

c The purpose of the service; it defines the target market and the customer experience

d None of the above

(v) Which of the following refers to a technique that determines the volume of demand needed to be profitable?

a Benefit cost ratio   b Payback period   c Process strategy   d Break-even analysis

(vi) A planning strategy that sets production equal to forecasted demand is known as

a Level Strategy   b Chase Strategy   c Mixed strategy   d none of the above

(vii) A schematic diagram that denotes location preference with different line thicknesses is known as _____

a Relationship diagram   b Block diagram   c Process layout   d None of the above

(viii) The Japanese word for the philosophy that defines management's role in continuously encouraging and implementing small improvements involving everyone is known as

a Kanban   b Kaizen   c Haiku   d None of the above

(ix) The amount by which an activity can be delayed without delaying any of the activities that follow it or the project as a whole is known as _____

a Crash time   b Optimistic time   c Dummy   d None of the above

(x) Which of the following method of forecasting refers to an iterative group process that aims consensus

a Delphi method   b Consumer market survey

c Sales force composite   d None of the above

(xi) A Level of inventory in stock at which a new order is placed is known as _____

a Service level   b Order cycle   c Stockout   d None of the above

(xii) In the context of linear programing, which of the following refer to mathematical symbols that represent levels of activity of an operation?

a Decision variables   b Constraints   c Slack variables   d Surplus variables

(xiii) The term "Jidoka" refers to

a A card corresponding to a standard quantity of production (or size container) used in the pull syste to authorize the production or withdrawal of goods

b Authority given to the workers to stop the assembly line when quality problems are encountered

c A tem used to describe JIT and the Toyota Production System (TPS)

d Any foolproof device or mechanism that prevents defects from occurring

(xiv) Fish bone diagram is also known as

a Pareto Chart   b Value stream map   c Time function map   d None of the above

(xv) The time required by an "average" worker to perform a job once under normal circumstances and conditions is known as

a Normal time   b Predetermined motion times   c Standard time   d None of the above

(xvi) An investment in a particular venture is considered economically beneficial if

a Minimum Attractive Rate of Return (MARR) is less than Internal Rate of Return (IRR)

b Minimum Attractive Rate of Return (MARR) is more than Internal Rate of Return (IRR)

c Minimum Attractive Rate of Return (MARR) is equal to Internal Rate of Return (IRR)

d No such criteria exists for evaluating the economical viability of investment

(xvii) When demand variability is magnified at various upstream points in the supply chain, it is known as

a Extranets   b Bullwhip effect   c Cross-docking   d None of the above

(xviii) The worth of an equipment or asset as shown on the accounting record of a company is known as

a Value added   b Esteem value   c Book value   d Salvage value

(xix) The cost which has occurred in the past and is common to all feasible alternatives to be considered for future

a Variable cost   b Marginal cost   c Opportunity cost   d Sunk cost

(xx) When higher levels of output cost more per unit to produce, it is known as _____

a Economies of scale   b Diseconomies of scale

c Sunk cost   d Quantity production